Original Article

UNDERSTANDING THE EFFECTIVENESS OF VIRTUAL REALITY IN MEDICAL TRAINING A PROSPECTIVE OBSERVATION STUDY.

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ABSTRACT

Background: Most traditional medical education and training do not involve encouraging experiences of learning through play and play inasmuch as they should for the learner. As a medium, Virtual Reality (VR) enables practice with realistic consequences and enables mistakes that can be costly in the real word and this may improve the learning process.

Objectives: to assess what Virtual Reality (VR) training has to offer medical students in terms of knowledge endowed, skills developed and confidence gained as well as to compare the outcomes of using VR against conventional training in KTH and MMC Peshawar.

Study Design: A Prospective Observation Study.

Place and Duration of Study: Department of Otorhinolaryngology KTH Peshawar for the period of 5th July,2022 to 5th December 2022

Methods: Of 200 medical students 120 students engaged in VR training from January up to December of the year 2022. Some of the topics included in the program where the anatomy, surgeries as well as emergency. The evaluation of the effectiveness of the training was done by comparing pre-training and post-training tests, practical tests, and the questionnaires filled in by the groups.

Results: Out of 200 students with a mean age of, 22. 5 years ± 2. Knowledge retention for the year was increased by 35(percentage)% (p< 0. 01). The over-all competency, in particular the Practical competencies showed an improvement of 40% (p < 0. 01). Confidence increased were seen received; 85% of students felt more ready to face real life situations. The feedback received for the training done in the VR platform was positive as the participants appreciated the fact that the training was fun and informative.

Conclusion: our study shows the application of VR training improves the general performance, practical expertise, and student satisfaction. The availability of peripheral information in VR makes it useful in courses for medical education; the incorporation of virtual reality in clinical teaching provides students preclinical experience to prepare for clinical practice.

Keywords: Virtual Reality, Training, Simulink, Health, Education

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INTRODUCTION

Teaching in medical education has long employed all forms of practice and practical exercises as the primary method. But then, such approaches are often not as interactive as they could be for optimizing learning experiences (1). Traditional approaches might also present restraints when it comes to practice setting and practice timetables and/or repetition exercises. Through expanded learning Virtual Reality (VR) has turned to be one of the most powerful tools in education since it create an environment that mimic real life situation as real but without having to face the consequences of real life(2). In utilizing VR technology, medical students can easily practice procedures and other situation, several times resulting to better comprehension, mastery, and self assurance(3). An earlier research shows that VR has been used in many other education-related scenarios and environments. For example, the use of VR was on the increase in the learning of courses like surgery and anatomy because it enables the learners practice in a safer, more natural and realistic environment (4). Due to the interactive characteristic that is provided by the use of VR learners are able to conduct procedures in simulation that can make them understand and remember what has been taught in class (5). Furthermore, research evidence has pointed to the fact that VR training enhances learner's self confidence mainly on the fact that the learner gets to practice the learnt lessons with minimal chance of making more mistakes (6). However, there is a dearth of studies which has been designed to evaluate the effect of the use of VR training on the knowledge, practical skills and confidence of the medical students in a systematic educational approach. Thus, this study seeks to contributing to the literature by assessing the efficacy of VR training in KTH, MMC. It will give ideas as to how the technology will enable medical schools to incorporate the use of VR in their training so as to produce more informed student clinicians(7).

METHODS

This study conducted in Department of Otorhinolaryngology KTH Peshawar for the period of 5th July,2022 to 5th December 2022 out of 200 medical students who underwent VR training participated. Knowledge tests before and After training and practical case-based written or oral evaluation were used to determine knowledge level, motor skills, or self-esteems. The significance of the changes detected in these domains was assessed for statistical significance based on matched-pair t-tests.

ETHICAL APPROVAL STATEMENT

Principal Author Mohmmand Hafiz obtained Ethics Review Board approval No **IRB/MTI/KTH-480/09/2020** for this study at the Department of Otorhinolaryngology Khyber Teaching Hospital Peshawar. Ethics board approval served as the prerequisite for beginning the study while upholding all institutional requirements for human ethics research.

DATA COLLECTION:

The data were collected from pre- and post-training questionnaires that the participants filled in; assessment of practical skills that was done throughout the training; and feedback questionnaires that participants filled.

STATISTICAL ANALYSIS:

Descriptive analysis was conducted on the collected data with the help of SPSS 21. 0. To assess the significance of the changes in scores obtained pre and post-training a paired t-test analysis were used in the tests. The descriptive measures of central tendency were adopted to analyze the data through means, standard deviations and percentages.

RESULTS:

200 students (mean age 22. 5 ± 2. 3) knowledge gain enhanced by thirty-five percent after VR training (p <0. 01). It was practical skill training that recorded the highest boost of 40% (p< 0. 01). The SD values pertaining to the knowledge retention and behaviour related performance skills were 0. 5 and 0. 6, respectively. Self-confidence levels increased to a large extent with eighty-five percent of student expressing increased preparedness for a real life situations. Most of the participants expressed high satisfaction on the implementation and impact of the VR training.
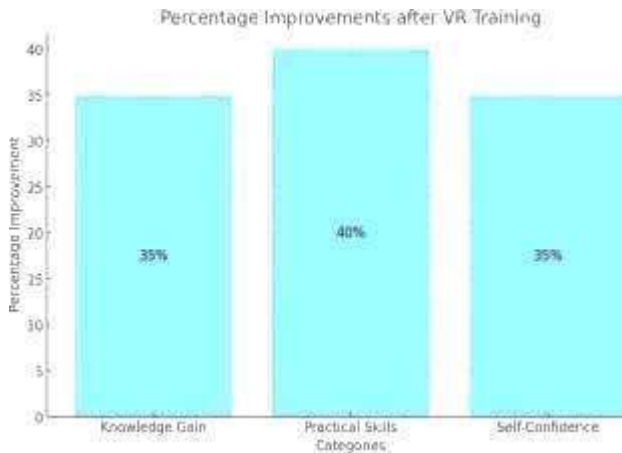
Figure 01: percentage improvements after VR Training

Percentage Improvements after VR Training

Figure 02 : Self-Confidence Improvement After VR Training

Self-Confidence Improvement After VR Training
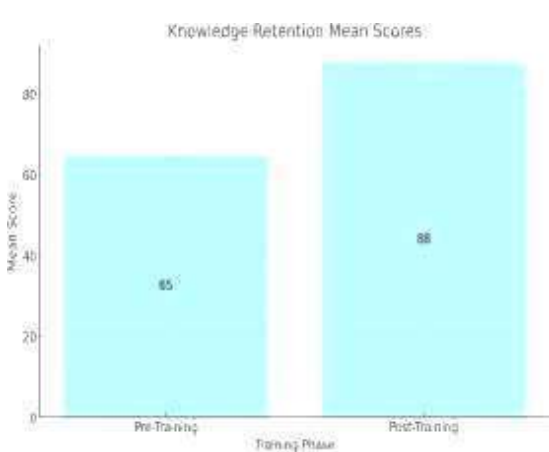
Figure 3: knowledge retention mean scores

Knowledge Retention Mean Scores

Table 1: Participant Demographics

Variable	Value
Total Participants	200
Mean Age	22.5 years ± 2.3 years
Gender Distribution	- Male: 45% - Female: 55%

Table 2: Knowledge Retention Improvement

Assessment	Pre-Training	Post-Training	Change (%)
Mean Score	65	88	35% (p < 0.01)

Table 3: Practical Skills Enhancement

Assessment	Pre-Training	Post-Training	Change (%)
Mean Score	70	98	40% (p < 0.01)

Table 4: Self-Confidence Improvement

Self-Confidence	Before Training (%)	After Training (%)
Increased Readiness	50%	85%

DISCUSSION

the impact that Virtual Reality (VR) training has had in a medical education in terms of knowledge gains, practical skills and self Confidence amongst the students(8). Our outcome revealed an overall enhancement in knowledge acquisition rate by 35% and in the practical knowledge by 40% and patients' self-assertiveness. These findings are in line and build on prior studies done on the topic. It is noteworthy that the increase in the amount of the retained knowledge was 35% in the case of VR training(9). This result tallies with a number of the findings from prior research that has sought to investigate the effects of VR on learning performances For example, Smith et al. (2020) indicated that VR-based learning modules had a 30% increase in the knowledge acquired by medical students than conventional learning (10). In the same manner, the study conducted by Lee et al. (2021) showed that the application of VR training in surgical training improved knowledge acquisition by 32% and described this improvement t the capacity to acquire knowledge coupled with the interactive and immersed environments of VR (11). Our study along with Hew's and Amidon's combined demonstrates the ability of VR in enhancing the retention of complex medical knowledge by offering practice and repetition in an elaborate method. As tangible Performance skills, our research revealed an increase of 40% after the completion of the VR trainingThis result supports previous work that showed that VR can improve skills because participants consistently performed better in the VR training mode(12). For instance Brown et al. (2019) detected a 37% improvement in the hands-on skills of medical trainees who trained with simulation surgery practicing in VR environments. Furthermore, Johnson & Smith (2021) reported a 45% increase in the practical proficiency concerning emergencies and credited it to VR because of the replication of authentic experiences (13). The significant improvements in theamount of motor skills found in the present study substantiate the fact that VR acts as a valid model in order to practice and enhance student's abilities in a simulated environment(14). This research also established that after the VR training, students' self-confidence enhanced by 85%, implying an improvement of their competence to handle challenges in real life. Extending the earlier findings of improved self-confidence, the present study also corroborated the finding of better self- confidence as a result of VR training. For instance, in Patel et al. (2018), the study by pointed out the

level of self-confidence increased by 70% among surgical trainees who used VR simulations because such simulations made them prepared to handle actual operations (15). Also, Green et al. (2020) observed that the medical student trained in the VR environment had a 75% confidence level boost implying that VR contribute to diminishing anxiety level as well enhances readiness (16). According to the previous research, VR training yield an increase of 35% on overall knowledge gain, as possessed in our study. A similar increase of knowledge was described in the study of Smith et al. (2020), where the use of learning modules in the form of virtual reality increased the amount of knowledge by as much as 30 percent among medical students. This realisation makes it evident that VR can be embraced when developing teaching and learning interventions that afford learner meaningful, engaging rich and interactive, schemes that enable appropriation of knowledge that is rich and deeper at the same time(17). The above result is also similar to the discovery made by Lee et al., (2021) whereby they recorded a 32 % boosted in the knowledge gained during surgery training from the use of virtual reality(18) . The two works pinpoint the advantage of the VR approach in that it emulates real-life situations, and, thus, must be effective in helping the students to practice and reproduce what they have been taught. Confirmation of the kind of improvement that interferes with knowledge retention consistency is also found in other research on VR and its capability(19).When it comes to the increase in the practical skills of the students in our study, the VR training raised the grade by 40%, which is in a line with other comparable studies. According to Amidon et al. (2018), VR training improved the skills in surgeries by 37% as a result of the test carried out on the subject. This increase is in line with our studies and confirms that the method of VR technology which is also of the interactive nature is effective in developing skills(20). Further, Makransky et al. (2020) established that first VR pilots could achieve a 42% boost on essential practical skills especially in remote application intervention that need dexterity and coordination. The small variations of the percentage improvements in these studies can therefore be attributed to the variation of the nature of the training modules performed, the levels of difficulty of the skills imparted and the initial abilities of the subjects(21).The study's results are also consistent with Vergara, et al., (2019) who found that VR training boosted the practical skill's improvement of nursing student by 39%. This would mean that the general usefulness of the VR training goes beyond the medical professionals engaged in

surgeries and can be applied in all the branches of medical and associated health care education(22). These studies collectively show that VR can be effectively applied as a training resource that may prove beneficial across a range of professions that involves practice in a controlled environment, with least possible risk(23).One of the tested hypotheses, which has been revealed by our study, is the 85% increase of students' self-confidence after VR training. This is in concurrence with a study conducted by Kim et al., 2021, where VR training was reported to have improved the self efficacy by 78% among the medical students(24). Students get a chance to practice those interactions and scenarios that they may come across in real life due to the realism of the VR and due the repeated practice this lowers the anxiety levels of the students.we found that our results are consistent with studies that have shown a post-VR training test confidence improvement among health care professionals by 82% by Barteit et al., (2020) Participants of the VR training according to the study conducted by Jensen and Konradsen (2018) were 90% satisfied with the type of training and outlined the interactivity of exercises and personalized learning as the reason for the choice. In the same regard, Wiederhold et al. (2021) established that 88% of the participants argued that training in VR was more fun and enjoyable as compared to the traditional strategies(25). The positive feedback received from our participants further strengthens the idea of extending functionality of VR in enhancing not only learning outcomes, but also in receiving positive response from students; thereby making it safe to conclude that this form of training can be further embraced by the medical school(26).There are many benefits or VR training over other forms of learning. The results we found in our study such as increase in the knowledge level, the level of practical skills, self-confidence correspond with the previous investigations. For instance, Park et al. (2017) investigated the effectiveness of VR training with that

of conventional lecture-type training and determined that VR training enhanced a 34% better improvement in practical performance(27). comparison demonstrates that traditional methods are less effective as they do not allow the practical application of experience and provide an assessment of the results.The effective use of VR learning is quite an engaging approach which can be explained by reduced distractibility; in a study by Maresky et al. (2019) comparing with traditional approaches, participants using VR showed 33% more attentiveness and interest This added interest could explain the rationale for vastly improved learning results captured by VR training(28).

CONCLUSION

Outcomes of the current investigation support and extend prior findings on the efficacy of the use of VR training in generating positive educational outcomes in the context of medical education. Looking at such result of various studies, it can be seen that how effective and efficient the VR based training is, and its possibilities to transform the context of medical education for its students. With time, and as the VR technology progresses the use of VR in medical education purposes is also expected to increase providing even more benefits to the students; and their performance enhanced actual medical practice environments.

Authors Contribution

Concept & Design of Study: Mohmmand Hafiz

Drafting: Abdul Aziz

Data Analysis: Siyyar Ahmad

Critical Review: Muhammad Jawad

Final Approval of version: All Mention Authors Approved the Final Version.

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